FLIGHT OF THE VOYAGER

HEARING

BEFORE THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

ONE HUNDREDTH CONGRESS

FIRST SESSION

FEBRUARY 3, 1987

[No. 2]

Printed for the use of the
Committee on Science, Space, and Technology

U.S. GOVERNMENT PRINTING OFFICE

71-320 WASHINGTON · 1987

For sale by the Superintendent of Documents, Congressional Sales Office
U.S. Government Printing Office, Washington, DC 20402

H701-48

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***Elected March 30, 1987 (H. Res. 133).

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FLIGHT OF THE VOYAGER

TUESDAY, FEBRUARY 3, 1987

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The committee met at 10 a.m., in room 2318, Rayburn House Office Building, Hon. Robert A. Roe (chairman of the committee), presiding.

The CHAIRMAN. The committee will come to order.

And without objection, television broadcast, radio broadcast, still photography, other means of coverage will be permitted during the full committee hearings today.

On behalf of the Committee on Science, Space, and Technology, I would like to welcome the two distinguished aviators responsible for the Voyager's extraordinary flight. We are honored and proud to have them with us today.

We applaud both the courage and the dedication of pilots Jeana Yeager and Dick Rutan. And we also wish to pay tribute to the Voyager's designer, Burt Rutan, who could not be with us this morning.

Our committee strongly supports and encourages the spirit of creativity and innovation of this team of three outstanding Americans and all of those courages that they have exhibited. We have underscored continuously the importance of providing an environment for creativity to flourish in all of the Nation's scientific and technological efforts. The Voyager feat confirms to the world not only the strength of America's ingenuity but also the boldness of its patriots.

American aviation has written the history books on man's capability to conquer the skies—first to fly, and then to soar even higher and higher, and freer. In the tradition of the Wright Brothers and of Charles Lindbergh, these three brave individuals have written—have written yet another epic chapter in world aviation history. The Voyager odyssey was a magnificent combination of ingenious concept, imaginative airplane, credible—and incredible courage, and invincible will.

Joining us to pay homage to three aviators is Major General Leigh Wade, one of the three pilots who completed the U.S. Army's first round-the-world flight. The record book tells us that the engine in General Wade's Douglas "World Cruiser" was replaced 12 times during its flight. And I believe the flight--and, General, you will have to check me on this—took 170 days, as my memory reminds me. And we want to extend our thanks to him for participating in this tribute.

But before we go further and I introduce the other distinguished members here and call upon the ranking minority leader, Manuel Lujan from New Mexico, I think that we ought to pay a high regard to General Wade. I understand it was his birthday yesterday—and for you who that don't know his great feats—what is it, 29, General? I believe it is 29th year. Congratulations. Happy birthday. [Applause.]

I had a chat with the General before we started our hearings and he—we had a discuission as to whether or not he would want to be a candidate for the next shuttle that we are going to fly, and he said that he had the opportunity to talk with the people in NASA, and the first question they asked him was how old he was. And he wasn't too responsive—he says, well, I'm old enough, I've flown before.

And the—that's right, there's more to the story. Then they said to him, well, really how old are you? They said, are you 60 or over? He said, well, I'm a little bit over 60. They said, well, we're not going to fly anybody that's over 60. So the General is 90, and we'll just divide it in two and we are going to let you be on that flight the next time around, General. Congratulations and happy birthday. [Applause.]

[The prepared opening remarks of Mr. Roe follows:]

HON. ROBERT A. ROE, OPENING REMARKS, VOYAGER HEARING: FEBRUARY 3, 1987

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Miss Yeager and Colonel Rutan, we have tracked your many miles of flight and anxiously waited through your hours of tribulation; now we are eager to hear your story. Like Emerson, we recognize that there is no history, only biography—and yours fills all Americans with pride.

The CHAIRMAN. Now the Chair defers to the distinguished ranking minority leader, Mr. Lujan from New Mexico.

Mr. LUJAN. Thank you, Mr. Chairman. And it's always more enjoyable, of course, to hold a hearing to honor someone for a spectacular achievement than it is to debate the merit of some controversial program or policy. So it gives me great pleasure to welcome these brave aviators who appear before us this morning.

There's certainly no debate where they're concerned. We all applaud their success, not so much for the technological achievement that it was—although it was certainly a tribute to the design genius of Burt Rutan—but mostly because it exemplifies all the qualities that we associate with Americans: genius, imagination, vision, courage, and just plain hard work and determination. Rare qualities, indeed, Mr. Chairman.

Now, professionally, we become so accustomed to being asked for Federal assistance, that it was indeed refreshing to see that there are still individuals who want to do something on their—on their own. Certainly one of the most significant aspects of this achievement is that it was a private and a personal triumph.

So I congratulate you, Dick, and Jeana, and I so ask that you extend our congratulations to Burt, who designed the vehicle that made this momentous journey around the world, and I'm sorry that he couldn't join us today. But to you, our most heartfelt congratulations.

Thank you, Mr. Chairman.

The CHAIRMAN. I thank the gentleman from New Mexico.

The Chair recognizes the distinguished chairman-designate, Mr. McCurdy from Oklahoma.

Mr. MCCURDY. Thank you, Mr. Chairman.

I'd like to pay my personal respects to the Voyager progam and its people. Jeana Yeager and Dick Rutan are two people who have had an experience that is available to no one else on earth. I salute you for your courage, bravery, and ingenuity.

Since the Subcommittee on Transportation, Aviation, and Materiels is responsible for aeronautical research, we can really appreciate an airplane that has such a small amount of its weight devoted to structure. I know that we will hear a great deal more about the Voyager today and its historic flight.

I am very interested to learn, for example, the true purpose of the winglets—the subject of much concern at takeoff.

We certainly appreciate you being here today. Look forward to sharing your experiences during this remarkable flight, and again salute you for your incredible courage, and allowing the entire world to participate in such a historic voyage. It's something that we all are extremely proud of, and I think will long live in the history books, and certainly in the area of aviation as one of the most remarkable feats. We look forward to your testimony.

Thank you, Mr. Chairman.

[The prepared opening remarks of Mr. McCurdy follows:]

OPENING REMARKS OF HON. DAVE MCCURDY, CHAIRMAN, SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS, COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY: FEBRUARY 3, 1987

"FLIGHT OF THE VOYAGER"

I would like to pay my personal respects to the Voyager program and its people. Jeana Yeager and Dick Rutan are two people who have had an experience that is available to no one else on earth. I salute you for your courage, bravery, and ingenuity.

Since my Subcommittee is responsible for aeronautical research, we can really appreciate an airplane that has such a small amount of its weight devoted to structure. I know that we will hear a great deal more about the Voyager and its historic

flight this morning. I am very interested to learn, for example, the true purpose of the winglets, the subject of much concern at takeoff.

We appreciate your being here today to share your experiences during this remarkable flight.

The CHAIRMAN. I thank the gentleman from Oklahoma.

Now before we call on our guests to respond I want to recognize Mr. Peter Riva, who's coordinator, I believe, for both Dick and Jeana. And I understand, Jeana, that you flew home and flew all the way back last night so you didn't get much rest last night, they tell me. And then one of the wags up here made the point if you will, god, those folks flew for nine days, so in that instance we understand.

We want to hear a little bit from you folks as to what your observations were, the excitement of what you have achieved, and also to lend some insight into some of the materials and the decisions you made, particularly in the selection of the oil that was used, the engine liquid—was liquid-cooled, I understand. We understand you had special helmets to filter out noise, and I'm also interested in the composite materials and your observations and reviews as to that.

I do also want to take the time now for a second, however, to introduce my good friend Don Clausen, Congressman Don Clausen, who is now Director of Special Programs for FAA. And we consider him to be a Congressman emeritus as far as this committee is concerned.

So now, who should we let lead off? Dick, do you want to lead off?

STATEMENTS OF DICK RUTAN AND JEANA YEAGER, COPILOTS AND BUILDERS, ACCOMPANIED BY PETER RIVA, VOYAGER SPOKESPERSON AND MARKETING DIRECTOR

Mr. RUTAN. Well, thank you very much. And it's indeed an honor to be here, maybe a little overwhelming, but certainly an honor, and I appreciate that, especially to be in the presence of General Wade, who I've admired for quite some time.

Just to start off before we show a little slide presentation that may help me with some notes in my little talk is that what has happened here is to me is more significant than the technological accomplishment that we spoke about, and that is that, first of all, this is the first time since before World War II that a citizen, an individual, has ever held an absolute record. Now there's many subtitles of records but those have all been held by the efforts of major corporations, or indeed large governments, to hold those records. And we're very proud of that to hold two absolute records for this project and it was done by a citizen. And—and we should all be proud of that because it allowed us to do that not because it's Dick and Jeana or Burt or Peter, but because it was citizens of a free country.

And if I have anything that I would like to say to leave with you all here is something we found very precious, especially with our—the bureaucracy that we work with, that being the FAA, and I want to thank them for the freedom we've had to do this thing completely without any interference from what we thought was best to accomplish what we thought was a very significant goal. We

used our own ingenuity and in a free environment to accomplish that and I want to thank that, and I hope that you will maintain the freedom of citizens to take a risk, and this country needs to have an environment where it can have an opportunity to take a risk—and indeed this was a risk venture—and the opportunity to fail, and also the opportunity to succeed.

And without that kind of an environment it's not a world I want to live in, and I'm sure it's not a world that any of you would want to live in either. So when you think about protecting our freedoms—I'm sorry—when you think about protecting our safety, be very careful that you don't take our freedoms away from us. And that's very important.

I'll quickly run through my slide presentation and try to accentuate some of the areas that you have questioned. And if you'll forgive me, that this was—this presentation is supposed to run a little longer but we'll run through it if you'll bear with me.

The CHAIRMAN. You want to—someone want to get the lights, please.

[Slide presentation.]

Mr. RUTAN. I usually like to start this thing by putting it in a—in a perspective of what this means in the world of record-breaking. And this is the first opportunity—I've shown this slide many times for the last three or four years, and the first opportunity I've ever had—had the individual here that actually those airplanes.

Of course, this is the Douglas "World Cruisers" that flew around the world the first time in 1924, and I'd like to talk to the General a little bit more about the details of that during our lunch. But world flight in the late '20s, the Graf zeppelin; and in the early '30s there was Wiley Post and, of course, Amelia Earhart, she lost her life in the Pacific on a world flight attempt in the '30s; and also your friend and mine, Uncle Howard, in the late '30s, he reduced the record from—with some very nice equipment for the time, down to 3½ days for a world flight.

But I don't want to take anything away from these people because they were very significant achievements. However, they were very short flights, high in the northern hemisphere, which not—would not even qualify today for a legal world flight. Those were 15,000 miles. We require over 22,000 miles to be certified and, of course, the world is 25,000 miles in circumference.

One of the initial—one of the initial goals of the Voyager project was to fly around the world. We thought it was important to fly all around the world. And we wanted to fly at least 25,000 miles. We flew 25,012 statute miles.

In the world of—of records, were—when we started this project, what was the current distant records, to give you some feel of what we—of what the current state was for a propeller-driven airplane. This is an airplane that was—set a straight line distance record in 1946, the "Truculent Turtle." It flew, in round numbers, halfway around the world.

The first airplane to ever fly around the world nonstop was the "Lucky Lady II." And it was in the late '40s also, but it was only made possible by multiple aerial refuelings by B-29 tankers.

The current distance record—I said it again, didn't I?

Mr. RIVA. You did.

Mr. RUTAN. I spent three years saying the current distance record is. The previous current distance record——

[Laughter and applause.]

Is held by the B–52 bomber, which is a national effort. And it was basically halfway around the world—12 and a half thousand miles. Now for us to be successful in our project we had to double the current absolute distance record.

The designer, the brainchild for this whole thing, is the man that thought it could be possible. If he thought he could design an airplane, Jeana and I thought we could build it, and we could fly it around the world. That all started in 1981 in a little restaurant in Mojave drawn on the back of a napkin.

Burt is a prolific designer. He's designed many airplanes, a few of the ones that you see here. Some of his futuristic airplanes is the Starship—advanced aerodynamics and, of course, made out of the composite material that will be used in aviation in the future.

Our planned trip was all over water. We wanted to avoid coop—uncooperative governments and allow us the freedom to deviate at will from winds and weather.

As you can see by our intended route, it's about as far away from Khomeini as you can get. [Laughter.]

We're in Mojave. Mojave is also an excellent area for freedom. It's a small town, excellent as a runway; a field that was abandoned by the military in 1954, and allows us complete freedom to fly the different kinds of airplanes.

It has been said that this is the last bastion of cowboy flying left in the world. And some days, if you're ever there, you would agree with me.

This is the airplane that we conceived six years ago, and it looks pretty much the way it does now. To make this flight possible, we need to have two things primarily: advanced aerodynamics for stability and efficiency, and another thing was the use of composite materials.

My brother felt that this flight was not possible with conventional aluminum technology in airplanes because a large percentage of the weight of the airplane at takeoff must be fuel and not structures. The airplane has a capability of 80 percent of its takeoff fuel——

Mr. RIVA. Weight.

Mr. RUTAN. Of its takeoff weight was fuel. Up until now it's very difficult to achieve a 50/50 ratio. The Voyager is capable of 80 percent based on composites. Composite material is just that—it's a composite of different types of fibers oriented to achieve the structural requirements without a lot of structural redundancies that you find in other conventional materials such as aluminum—magnamite graphite, different types of fiber glasses, paper honeycomb core, bonding agents—a totally different approach to it. However, what we find is a material that is extremely strong and very light.

The Voyager is entirely made out of composite material. Its primary structure is carbon fiber, from tip to tip. The only metal that's in it is the metal that we use in the bolts to bolt the thing together. Here's some of its pre-assembly. It's taking shape a little bit more.

When it was assembled, when the red crane finally put the last wing on, the airplane had a wing span in excess of that of a Boeing 727. What was the wing span?

Mr. RIVA. 110——

Ms. YEAGER. 110.8.

Mr. RUTAN. Jeana knows all the numbers so she will have to help me.

Everything in the airplane was very special. I might say now that we thought that it was not possible for the major aerospace industries to accomplish this flight because they have to work by the rules in a lot of cases. Because of the freedom we are—we have the freedom to take a risk and we eliminated a lot of the rules that's normal, that you normally find in aviation practices, such as lightning protection, or crash survivability, or seat belt restraints, and so forth—very lightweight systems.

We worked on the premise that we had to save grams, not pounds, on this flight. Every item that went into the airplane, we looked at it, and every gram we could save. Because every pound of weight that we could take out, we could take out six pounds of fuel—that being a 6-to-1 ratio.

This is a 12,000 pound airplane. It's heavy as a Beechcraft King Air, or Super King Air 200, with all maximum gross weight.

The main landing gear on this airplane to hold all that weight weighed 27 pounds, that included the air in the tires.

The airplane's finally assembly for rollout in the summer of 1984. We thought it was a beautiful airplane. Again, we had no financing for this thing. We had to use hand-carved wooden propellers and some old, long worn-out engines, just to see if the thing would fly.

After the rollout we went through a flight—a flight test program. Mainly since it didn't have a—didn't have an electric starter or electrical system—in fact we flew the airplane initially with a hand-held radio that was borrowed. Had a special starter to start this airplane. We call it a Hemingway starter. You've heard of Ernest Hemingway—a Farewell to Arms? [Laughter.]

As in any flight test program—and I've been involved in quite a few—low and high-speed taxi like a small runway liftoffs—and all of those seem to be very satisfactory. This is a brand-new, different airplane.

The decision to fly was made by the principals involved and we had the meeting there at the side of the airplane. The weather was perfect. Our preliminary flight test evaluation was in good shape. Jeana sealed the canopy on. We taxied to the end of the runway. This is a first up and away flight of an airplane—a very strange, different configuration airplane.

And as Scott Crossfield will know and appreciate, as you sit on the end of the runway on a brand-new airplane ready to fly above what I call nosebleed altitude, as you advance the throttles to roll down the runway, you wonder what the next five minutes of your life is going to be like. Hopefully it will be very boring.

But the airplane flew very satisfactory. Its flying controls were adequate.

The criteria for this airplane, since it was a one-of-a-kind airplane to fly a single mission only, the flying qualities had to be

mission-adequate it was classified, and that is it can make shallow turns and climbs, and be able to hold level flight.

It's not a very stringent criteria, but the Voyager met those criteria—but just barely.

We were concerned about wing flexing. The wing tips have—have a structural capability, or so its been said, to translate 30 feet from center—30 feet up to 30 feet down. What you see here is about an 8 foot deflection. Now, the aerolastics—the aerolastic qualities of this thing can convert into a pitch oscillation that could be divergent.

The initial flight test of the airplane showed that this was not the case and all the oscillations were positively damped. However, in the last part of the program when we went to heavy weight at higher speeds, we found that they were divergently damped, and in fact the airplane would go through a divergent pitch oscillation that would go to double amplitude every cycle and a half, and that meant that the airplane would probably fail structurally at the end of its sixth cycle, or within 15 seconds.

So when we're real heavy the airplane was very difficult to fly. In fact, it had to be flown by a special autopilot by the King Radio Corporation, which actually worked very satisfactorily.

Inside the cockpit is very small. There's room for one pilot to sit down and the other pilot to lay down beside—in the manner you see here.

We are also looking at weight in every way we could. Burt made the—the—Burt made the cockpit just big enough he says because the rules only require a life expectancy that you must survive the flight by 48 hours after landing. [Laughter.]

Being the true engineer with performance on his mind, he always said that any life in excess of 48 hours after landing is just wasted capability. [Laughter.]

Jeana's looking with all this weight problems we have—she's thinking, and you can see it in her eyes, if all that nose is really necessary. [Laughter.]

And subsequently she cut her hair.

That was a quarter of a mile range. Did you ever try to swim a quarter of a mile in a rough ocean?

Here's the initial configuration we laid out. It gives you some idea of the crew area that we had to work with. We should have spent a lot more time in this cockpit that we built before we built the airplane, because although it was possible to change positions in this mockup, it wasn't what we found in flight with all the gear on board it wasn't impossible, that it was so close it would water your eyes.

Here's a series of slides that shows a crew change. I lay down to slide backwards head first submarine into the back. Jeana's up front if you can see her on her hands and knees by my knees to the left. As I slide into the back, she goes ahead and rolls into the seat. And then you can see my legs sticking out. That's where we slept. And then she is in the pilot's position at that time.

It takes about anywhere from 30 seconds to a minute depending on the urgency of the situation to do a crew change. Very small.

In 1986, July of last year, on just one of the warmup flights, we attempted a close course distance flight. Five flights off the coast of

California. The—I'm sorry, I got a little ahead of myself. That was the glad-to-be-alive party. This is some of the only aerodynamics changes we made was that little anti-servo tab on the elevator. A lot of that stuff came out of the hobby shop—radio-controlled equipment to save weight.

Someone accused us of trying the—people ask how you go to the bathroom in this thing. Of course I know nobody would ask that here. But, anyway, that's our first attempt, and I tell them about that bucket. [Laughter.]

The engines are very special. Initially we said that we were not in—we were not going to develop engines and propellers. We were going to make this mission based on aerodynamics and structures.

Teledyne Continental Motors offered us an engine that had been developed for a military program, at which we were not privy to. It was a liquid-cooled version of one of their engines. It provided very high compression ratios in advanced high-swirl turbulence combustion chamber. And the ability, because of liquid cooling, to run at an extremely lean burn condition, which improved our field specific as much as 20 percent over what we could expect over a normal air-cooled engine.

It was a significant—significant item to our project because it meant is that now we could fly the mission, and we could leave almost a ton of fuel home. As you can imagine, trying to take off with a ton less fuel is quite—quite advantageous as we sat on the end of the runway at Edwards.

But the engine worked very well. It had, with the mobile provided a special synthetic oil that would run without any oil maintenance for over 300 hours, and the liquid cooling with better tolerances, our oil burn was considerably down, and also our fuel consumption was down.

And it maintained an excellent fuel specific even at a lower percentage power, which is very advantageous to us, because we start out, when the airplane is very heavy, at probably 110 knots, but we end up at about 58 knots. At that point the airplane is burning less than two gallons an hour at a very low percentage power where engines are not normally very efficient.

The front engine was a—the front engine was a standard air-cooled engine because we didn't want to do too much experimentation with experimental items, especially in a propulsion unit of the airplane.

King Radio provided a very sophisticated avionics package: navigation, radar, very special autopilot, VLF Omega, and satellite navigation system, which also should be navigation system of the future. It worked very satisfactory on this project.

Our communications were provided by a UHF satellite voice communication and also a standard HF radio—radio communication relay throughout the world, would allowed us—allowed us to have a full-time communication with our mission control center.

On July, on one of our test flights, we were trying to determine long-range machine air-cool interface, and we flew the airplane for five nights, shuttling off the coast of California in an attempt to break the absolute close course distance record.

The flight was structured so that we could just—just barely break it, because we knew that we were going to shatter it when we went around the world.

The airplane flew very satisfactorily. We found we had very—that we adapted to the environment a lot better than what we had anticipated. Other than a problem with some dehydration that both of us experienced, other than that, it felt pretty good. After a few days you adapt and you felt like you'd been there all your life. And sometimes over the Atlantic on this flight, it seemed like it was going to be all our life, too.

Anyway, the flight worked very well. And we were very happy after landing to have as, here we go citizens again, acquired for our little project and absolute distance record.

Now from this summer in July we were—our program said that we were supposed to depart on September for an attempted world flight. Things were coming together very nicely. Our mission control volunteers were coming together; our—our mission control weather, access to all the weather satellites, the team was coming together. The airplane was almost finished.

This was a test flight where we are going to evaluate this problem we had with pitch instability that I spoke of a minute ago. This would have been the last flight before we are ready to go.

And when disaster struck we lost a propeller blade—came off the front engine. Normally that is a—that's a loss of airplane item, where it usually tears the engine right out of the airplane. But we are very fortunate to have survived that, although it did, what the crew chief termed "lunch" the front of the airplane. It broke engine mounts and tore the cowling up. It was a major setback to our project. The engine was virtually laying in the cowling.

Fortunately, the--fortunately, the engine mounts broke at—at very strategic locations that it didn't tear it out by the roots out of the composite structure. That would have meant a massive fuel leak and loss of airplane.

With the help—the encouragement of my colleague Peter Riva with the agencies that supported us, the avionics, the engine people—we had to do a whole new propeller program by TRW/Hartzell. All those companies, all those sponsors, made a gargantuan effort. In the matter of two weeks we had most of the components made and are ready for testing. And we had the airplane back in flight test less than two months to the time of failure. With the new Hartzell propellers, which actually proved to give us more range than the other ones, we are ready to go. However, the weather is deteriorating. We'd all—we'd planned that we could fly this mission up to the end of November. Here we were looking at the end of September—I'm sorry, the end of, or the middle of December, looking at what we considered a weather situation that was now almost unsatisfactory.

The weather team—by the way, Rich Wagner, Len Snellman, and—give us their whole support. The National Weather Service backed this thing a hundred percent, and we couldn't have asked for any better support.

They studied it—they studied another route, and they thought that we could go in a more northerly route above the intertropical convergent zone. There still was a chance to make it this year.

We were under considerable pressure to try to go because our team is together; a lot of the equipment was borrowed and we'd have to give it back. We could not make another attempt until the summer.

Although the weather was bad and our financial situation dictated, I didn't know how we were going to survive six months. So that in mind, we looked at another route that was farther north. However, it had to cross Central Africa, as you see here. There we're getting to the—into the area of uncooperative governments. And in this case the countries of Chad, Ethiopia, the Sudan, and Uganda denied overflight clearance. And basically what that did is it forced us down into an area of very, very bad weather.

The airplane was prepared for launch on the 13th—is that right? The day before the airplane was declared mission-ready. The next day the airplane was flown to Edwards Air Force Base and was positioned on scales for its final refueling. It took virtually all night to top the airplane off and to weigh it on its scales because the weight and balance of the airplane was very critical.

We had flown the airplane before at 85 percent of its gross weight. Never before had we tested the airplane at this weight. There was frost all over, so that—as for the blankets for protection.

Of course, the air crew, you always spend a nice restful night, don't you, Scott, before a flight like that—(laughter)—so when you wake up you're well rested. And the meal of the eggs and steak, you are consumed with a tremendous appetite, which couldn't be farther from the truth. And, uh, then you're ready to launch on this grand adventure. I'm being very facetious, because I don't think any one of us ate hardly any of the breakfast.

The airplane was positioned on the hammerhead of runway 04 at Edwards Air Force Base. That gave us 15,000 feet of runway with a—with the dry lake overrun, so in case of a heavyweight abort just before liftoff, we still had a reasonable chance of survival, because on any other runway that I can think of in the world, any abort after halfway down the runway would have ended in disaster.

One strange thing that happened during this—during this takeoff, and all of you have seen the wing tips that failed in the—that drug on the runway. And I'm sure that everybody thought how dumb that was—they put too much fuel in the wings and they were too heavy and they scraped.

Well, as the airplane sat in its final position on the runway, the wings did droop down near the runway, and we had probably six to eight inches of clearance static.

Somebody had the idea that we ought to blow the struts up, make the main struts higher and give us a little more clearance. Well, that and a combination of the extra fuel that we had in the boon tanks that morning bent the wings down to such that they had a negative angle of attack—none of us anticipated that.

So as the airplane rolled down the runway, the wings, instead of flying up as they normally had, they flew down. The faster we went, the harder they flew down. And, of course, the wing tips, they were damaged such that the—both wing tips failed within the next 20 minutes after departure. Here you see the right winglet gone, and the left one still there.

We ran into some turbulence over the mountains to get to the ocean. We yawed the airplane and porpoised it some more and actually got both winglets to flutter and fail and come off.

We are kind of go oriented, and I hate to turn around, especially since I've got that thing airborne, and if we still had a chance to make the mission where we're going to go for it. We were going to base that on initials—the initial first day out performance data. If we could meet our estimated performance for the airplane, we were going to continue, and it did turn out that way.

The winglets provided a vent mainly. Those of you that are more technically inclined, the high aspect ratio airplanes have less and less need for a winglet help. In high aspect ratio or high-induced drag areas the winglet helps significantly.1

This one here was a method just to get the winglet—the winglet height provided for fuel vents for the outboard tank. Here you see the fuel vent that was torn out of the winglet and there was some concern that it may have been blocked, but it didn't turn out to be the case.

Here the airplane was being chased by the Beechcraft Duchess as it went feet wet that morning all over the Pacific. It all seemed well. The systems were working well. We had more performance than what we had anticipated. The rates of climb after takeoff were anticipated to be about a hundred feet a minute, and we realized 250 to feet—to 300 feet per minute rate of climb, which I had mixed emotions because I was very happy that I was climbing, but very unhappy because I could have taken on a lot more fuel than what we actually did. By the way, the airplane ended up with less than one and a half percent of its takeoff fuel at arrival. 18.3 gallons.

We only needed enough to make it, right? [Laughter.]

Anyway, there was a lot of interest at Mojave and they give continually update briefings from our publicity people.

The flight was directed—the short thing on the methodology, we did not draw a black line on the route—on the map, and follow it. We went with the winds and weather dictated. There was a major hurricane in the Pacific called hurricane Marge. These people actually threaded us very close to the topside of the tail inside of the hurricane and between the feeder bands as they rotated. They kept us in reasonable smooth air, out of major weather systems. But the skill that they—that it took to do that was—I didn't appreciate that until we got back. I don't know if we had of been that comfortable knowing that what they were doing to us at the time.

But anyway, they were directing the flight. They had access to all three of the weather satellite systems and they made decisions every six hours and updated our—updated our route through transmitting refined weight points that we programmed into our computer, the on-board navigational computer.

We had a lot of problems with weather. Our studies of the weather system before we took off said that we would have six 8-hour respite between all the weather systems that we would encounter. That was not the case at all. We were in the equatorial tradewind area, near the equator, for the whole flight.

Down there the weather is more convective. Convective weather means turbulence, and a lot of it. Although we—we had excellent

tailwinds all the way to Central America, the weather denied us the ability to fly the airplane at its optimum altitude, and that's one of the reasons we ended up—we got home sooner because we had to fly faster, or higher, which meant a higher true air speed. But it also hurt our performance quite a bit.

So the—that combination with the tailwinds made it possible to get home. However, we did have very strong headwinds coming up the west coast of Central America.

Over Central Africa—the Central Africa crossing was the most demanding. At that point we encountered very severe—encountered very severe weather in the towering cumulus clouds that were at times just—where the airplane was just barely able to climb it at very high altitude.

Another problem we had is we had a fuel accountability problem that denied us—we could keep track of the fuel—well, we don't have time—but basically what it was is a backflow problem that was not accountable. So we had more fuel than we thought we had for a while. However, the bad news was we didn't know exactly how much. So until the tank started running dry toward the end of the mission we did not really know at that time how much fuel we had.

But as we're sitting there we're very discouraged because we're approaching Africa and our indications tell us that we don't even have enough fuel to make the Atlantic Ocean—and a very discouraging thing at best.

Now due to some tests made with performance with our chase airplane over Kenya and some of our people on the ground studying the fuel systems to try to determine why this phenomena was happening, and about the same time we did find that we were having a backflow indications in the cockpit and corrected it.

Now we knew we had more fuel—that they radioed to us instructions to tell us to determine how much. And that was based with this airplane on its performance for climb and cruise for single and—and twin engine operation. We did in fact have more fuel but we did not know how much.

Here is the airplane over Entebbe, over Central Africa. It's a wide angle lens but the storms completely encircled us and we were just barely able to climb through some of the canyons at the last minute at high altitude.

Jeana experienced some altitude sickness. She was nauseous. In fact, there was one time that I'd been up all day and all night. We got an average of about two hours of sleep per day for the whole flight. A lot—a lot less than what I thought we could manage.

The altitude caused her some nauseous conditions but there was no choice because I'd reached the end of my ability to fly anymore. And as I crawled in the back and went to sleep, I could see Jeana up there throwing up. But I tell you what, that little kid has got more courage than anybody you'd ever want to meet.

And sometimes that I was very discouraged and very fatigued and wondered what the hell I was doing here. And she'd rub my neck and I'd look at her and she says, come on, Dick, we can do this thing. And with that kind of encouragement that's what helped me make it.

Here we are at high altitude over Africa. I never understood why they'd let that bum fly an airplane like that. [Laughter.]

The weather over the rest of Africa was extremely hazy. Almost no time did we ever see the ground in Africa and very little time we ever saw the water because of the constant weather situations.

Like we said before, the mission control directed our flights in—in every activity. It's an excellent team. I thought the key to the success of this thing was more the work done on the ground than it was in the air.

It seems like every time that—there was one thing right after another due to oil starvation and the engine due to a fuel pump failure just off the coast of California—or Baja California. You look at the world and you can see Baja California, or just south of the coast of Mexico. If you put that into perspective for about how close we were to being home—at midnight, the night before we landed, and we landed eight o'clock the next morning, because of this transfer pump failure that also led indirectly to an engine failure.

The thing was when that happened it was late at night. And it was as dark as the inside of a cow because that moon had not come up yet. And I was very reluctant to start the other engine because it was an emergency restart and it meant that we're going to have to terminate the mission right there. It's a long procedure—starting the front engine, securing the back engine, and then finding a place, some Mexican runway, to abort the mission in.

We let the airplane go for quite a long time before we affected the front engine restart. However, and Mike Melville and my brother, he said that his teeth was in his heart at that time. I can appreciate that.

Anyway, we did get the front engine restarted, and due to the change in deck angle we were able to re-prime the pump, and the back engine restarted also. At that time we replumbed the fuel system and we found enough fuel to put in our feed tank—that we knew we had enough fuel to get home. That's the first time that we felt real happy about this whole project, and that was just within a half—half an hour's, dark at night, before we came home.

Now, there wasn't a better feeling that I had other than the warm welcome we received from everybody. Just after spending so many days out over the oceans, and with the mechanical failures, and the lights, and the weather, and being thrown in and out of thunderstorms—you see the lights, the glow of the City of Los Angeles as we came up the coast; that we in fact flew west, and we kept going west until we got back.

And, uh, I'm going to have to give up my membership in the flat earth society, I believe, because I'm a believer.

The recovering—the recovery at Edwards is something that completely surprised Jeana and myself. I had no idea of the interest that was being showed of the flight from takeoff. We had been so involved in making it a reality technically to get the thing launched that we had no real knowledge of what was going on on the ground, or if there would be any interest at all.

I made a comment over Los Angeles that I remembered that I left my car in Mojave and did not know if we could find a ride from Edwards back to Mojave to pick up the car. [Laughter.]

There was some indication when we called Edwards tower and asked them if we could interface with their usually busy flight test schedule at Edwards, and they said that they had shut down all activities and they're all here waiting for your arrival. That was a clue, wasn't it?

The next thing when we came across the cloud deck, even over central California there was still a lot of weather, although Edwards is clear at the time.

As we came—came across—doing pretty good so far—as we came across a cloud deck and saw the many thousands of people that are waiting for our arrival, it was some indication of what was to wait for us at the end.

[Film presentation.]

Mr. RUTAN. Here's the, uh, a series of movie sequence for the arrival and landing. Being an air show pilot, normally we put the landing gear down at high altitude to have the extra drag, but I saw all those people down there and I thought, gee whiz, they didn't come down here to see an airplane land, so I had to make a couple of low approaches across the crowd to show them what the airplane looked like and its cruise configuration.

President Reagan said he was screaming back there, and he says, land the damn thing, land the damn thing. [Laughter.]

Anyway, Jeana cranks each gear down individually. It takes about 10 or 15 minutes to get the landing gear down with little, tiny light cables. And here the left—the left gear is being cranked down into position.

Excuse me, I—I kind of choke up a little bit because I never were able to see these before from being inside the airplane.

But we made a few orbits over the crowd and over the dry lake getting ready to land. And here the left gear comes down, and about five minutes later. We had excellent weather for arrival at Edwards. The winds are smooth. The weather was good and the crowds were very friendly.

There's a lot of concern because most people—there's my father, and Gary Gunnell, a part of our team. There's a second pass with the right main bout—main mount, being extended. A lot of people weren't used to, uh, having one main gear come down at a time and they thought that something was very wrong.

There's a good look at the bottom of the airplane. The black area is there because we didn't bother to paint it. There's only about 5½ pounds of paint on the whole thing, only put on for just thermal protection from the top. There was no need to paint the bottom—it was just added weight.

There's General Twinting. He's the Commander of Edwards Air Force Base.

There's the final approach to land. I hadn't actually flown the airplane because it was all on autopilot for nine days. I didn't know if the fatigue, as we'd been up all day, all night, and into the next morning, whether it was possible—but if you look over there and see 50 to 100,000 people watching, you really try to do as good as you can. [Laughter.]

Right there is the area that where the space shuttle lands. It's exactly the same runway. We landed on a compass road just to the

side—just to the side of that runway. A very historic area—right in front of the NASA complex.

After seeing this film, it looked like a very smooth touchdown and a nice, smooth approach. I was kind of proud of that. It worked pretty good—after a guy—after a bum for nine days.

It landed a few minutes after eight o'clock on the 14th of December after nine days aloft and 25,012 miles, the first nonstop, unrefueled flight around the world.

[Applause.]

Its been a very long, hard project for us—and the financing to the flight itself, I felt like the weight of a thousand universe off my shoulders. Here's the NAA official that's taking pictures of the barrograph to confirm the record was actually official.

The first thing I wanted was my hat. We didn't take that along. Then to climb out of the airplane to find that the legs would really work.

If you look closely, after I take my harnass off, I'll attempt to climb down the ladder, and immediately I would determine that the legs were not going to support me at that time.

We required three bar—we require a barrograph to prove that we did not land en route. That was a very vital thing and we took three barrographs along—triple redundancy. Although we had no redundancies for any type of flight failure items, we had redundancies for getting credit for this thing. [Laughter.]

But this is the harnass, the lightweight harnass specially built that we wore the entire time, so if we had an emergency we could clip a little lightweight parachute on and bail out if we had to.

I am going to try my legs here and let's see what happens. Whoops! I told the doc, the flight surgeon in the blue hat, I says, I think I'll just sit here for a while, doc. And after a handful of minutes and exercising the legs sitting on the side of the airplane, then we could get down and walk.

There's my brother. I'm sure happy to see him. His idea and the design of an excellent airplane to accomplish what we considered a very difficult task was successful.

And there's some clothes that I wore for nine days straight without a change. You may—may notice an odd scratch if you look closely.

Jeana was also in good shape. We found that both of us had a minimal weight loss. I think Jeana lost nine pounds. I lost six.

After 18 hours of sleep, the next day I woke surprised to find both body and mind reasonably sound.

We built this thing and I wanted to see what it looked like, and you've got to walk around and—and look at the engines and to—to see what something that was denied us for nine days. And everything worked fine. The ground crew did an excellent job. The engines worked flawlessly. The only time we had an engine failure was no fault to the system, it was just a fuel system.

But the airplane worked fine. I—it's—because of the systems and lack of redundancies and aerodynamics, I consider that the airplane was basically a dangerous airplane to fly. It accomplishes its design task and we both decreed that it would never fly again.

I think that's all, Peter.

[Applause.]

The CHAIRMAN. We want to thank you for a very excellent presentation and a good overview of the—not only the flight but all of the human participation that went into your enterprise.

Jeana, how about you, would you like to give us a little response about some of your observations?

Ms. YEAGER. Dick said most all the——

The CHAIRMAN. Yeah, but we want to know whether he told everything that should have been told, that's why we're asking you. [Laughter.]

Ms. YEAGER. He did a very nice job of saying very much what I feel too.

The CHAIRMAN. Good.

Mr. Riva, do you have any comments you would like to make?

Mr. RIVA. Well, I've worked with Dick and Jeana, and I saw them accomplish 67 test flights before the world flight, which is number 68.

And finally on number 69, they returned the aircraft from Edwards to Mojave. And I got a phone call from Dick and Jeana and Dick said to me on the phone, well, you can rest easy now. And I hadn't been able to rest since the flight came back. I always had this sort of ominous feeling about that plane and the two of them, having become their friend as well as a colleague. And Dick says, well, you can rest easy now because I am. And I said, why is that Dick? And he said, because I ain't never flying it again. So——

It—it was an exciting project to be part of. All of us at Voyager, all the volunteers, during the mission there were about 45 of us—I think Dick still owes a lot of us a steak dinner because most of us got less sleep than he and Jeana did. It was a bet we had going.

The—the fact is that when you have two people who set goals and have a self-will and determination the way Dick and Jeana do, you either keep apace with them and do the best you can to equal what they're doing as far as their own personal goals are concerned, or else you drop by the wayside.

Over the six years of the program there have been quite a few people who have not been able to keep up with Dick and Jeana and who have fallen by the by.

But for those of us who saw them all the way through, we can only say that still to this day we're still marveling at what they did and we are very honored to be involved with them.

The CHAIRMAN. And I thank you.

We want to pay respects, of course, and high regard, to the team effort you had involved because as you mentioned, there was a great many people that did participate and help.

And now I also before we call on members of the committee to ask any questions they may have in mind, I want to recognize Scott Crossfield today, who's a distinguished American aviation expert with us, and also again General Wade. I'm going to skip over Scott for a minute, though, and ask the General what his observations were. We saw your first flight. Now, what do you think looking back and looking forward?

STATEMENT OF LEIGH WADE, MAJOR GENERAL, USAF (RETIRED)

General WADE. My voice isn't too powerful. That's why I want to get near a mike. But my thoughts were——

The CHAIRMAN. Peter, do you want to pull that microphone further to the General?

General WADE. During the interesting revelation about this flight, one thought predominated in my mind and that is our youth; and the next, our Congress and our government. Mind you, I thought of the people in the world that cannot read or write, how they live and how they exist, and the leadership of this Nation, starting with the Wright brothers on—and I wonder what are the youth of this Nation—pretty hard to overcome this recent accomplishment. And I think our public in the future will realize the importance of this flight because of the development of materials alone, along with everything else.

We can rejoice in this government of ours. I've flown all over South America and the way they came up there is very easy. My mind went back to my first flight over the Andes where I had learned up in New England about air currents, and I was using that to help me over. But the morning I went up to go over, the up current didn't come as I thought, and I said, well, this is my luck. And so consequently, I started to turn back to try again when the up currents caught me and I swirled in. They have a nice statue up on the top of the Andes, they have the Uspallata Pass, the statue of Christ. And I thought I could almost shake hands as I went by.

Now, in 1924, there were five nations competing in the world flight. Ours was the only successful one—Great Britain, Germany, Italy, and Argentina, South America.

Now, mind you, as I got over the Andes past the Uspallata Pass, and landed, it was daylight on the Argentine side but where I took off in Chile it was still darkness. I landed at a military base. There was one man walking out on the field. He had a swagger stick, same brown belt, so I knew he was an officer. And lo and behold, the first man I met in Argentina was Major Zond, who was attempting to fly around the world.

Excuse me, I'm a little emotional about this. But the thing is when we look at this recent achievement—and when we were kids what were we thinking about. I think it's perfectly marvelous. And what are the children in the future going to give us, and what the leadership for these children today depends so much on our leadership in the government. And let's give all the education and help we can to youth.

Thank you.

[Applause.]

The CHAIRMAN. Thank you, General.

The Chair recognizes the distinguished gentleman from New Mexico, Mr. Lujan.

Mr. LUJAN. Thank you very much, Mr. Chairman.

I guess the first question that comes to mind anytime something like this—like this happens is why? You know, other than—than to break the—the record, that certainly is—is a very noble goal.

But I'm just wondering about some other reasons. What you might have learned that would be something for aviation. You talk about the composites, maybe the engines, the instrumentation, the design, or what—beyond just breaking the—the record, can you give me some of——

Mr. RUTAN. Well, there was a lot of reasons. I don't think there was any single reason. We're in—we are of the aviation industry. I'm very proud of that. Its been very good to us. A very fulfilling career.

But something had disappointed me is that every time that our industry is reported to those people outside of the industry, I'd see headlines like "Pilot Saves Jets Death Plunge." Usually they're not very good about our industry, for some reason. The publicity isn't too good. And I wanted to do something neat for our industry. I wanted to have a positive headline for a change.

The other thing that we thought that this represented was an evolution, a kind of a—from one method of aviation to another that would——

Mr. RIVA. A renaissance.

Mr. RUTAN. A renaissance. A renaissance time, very similar to what happened in the '30s. In the '30s, airplanes were traditionally made out of tube and fabric, as was General Wade's airplane. And then there was a revolution came by with somebody that had a better material—they called it aluminum. And aluminum saved our—served our aviation industry very satisfactory for the last 40 years or so forth.

But as it—as it happened in the '30s, another thing has happened in the '80s exactly the same, and that is, that the age of aluminum is nearly over. And the next—the future of aviation and many other structural areas, from building bridges to, uh, fishing poles and tennis racquets, and you can go on, will be done with composite materials because they're more much more efficient, they're stronger, they can give us a safer item with more payload. They can be easier and cheaper to make.

Now—and I tell people that—that I don't know why anybody would want to build a new airplane, or anybody would ever want to buy one that's made out of aluminum—in 1987. Because those that are going to be alive in operation in the future in aviation and a lot of other things are going to do so by using composites.

Mr. LUJAN. So the composites—number one, certainly I can—I can see that that—that that's a great contribution. How about like the design or maybe your—your engines, uh, are those——

Mr. RUTAN. There's another—there's another thing that aviation has had to put up with for the last 40 years, or even since the dawn of aviation, and that is a—an aerodynamic departure, where we put up with a conventional tail—tail aft, which, uh, because of its inefficiencies, we needed that to derive our basic stability and control of a vehicle.

My brother has come along with the—the method of canard, where you marry the aerodynamic characteristics of a forward wing and into an aft wing, so that it can—can give you stall-free, spin immunity, departure of freedom, so that we don't have to stall and spin, if you would, anymore.

Another thing that we can get rid of the inefficience—inefficient tail, and we can use all of our surfaces to lift. Now, that type of thinking in a—in a change and how we derive those lift and stability derivatives of an airplane is a new—is a new way to do that, which also improve our efficiency and also the safety of airplanes.

Mr. LUJAN. One of the things that—that we're all pleased with, you know, is that you went out and did it, you did it on your own, and you talked about, uh, minimum of—of, uh—well, no government interference, just—just support. I—I was trying to find what that support was.

I have had—they've since passed away—a couple of friends that flew the Atlantic in a balloon the first time that—that it was ever done—Leonard Bruiser and Max Anderson, and Larry Newman. And at that time—the first time they went down near Greenland. But, as I remember, they had a Navy plane ready to—to pick them up.

Did you have that kind of support. You spoke of the weather service that you had. Did you have that kind of support that the military would be there if something happened?

Mr. RUTAN. Our scenario was that we had, uh—we had an emergency rescue beacon that was interrogated by three of our own satellites and two of the Russians that provided an instantaneous location. We didn't take any survival equipment for sea survival. We only took rescue equipment, knowing that we would not have a stay time of more than 48 hours because of that capability worldwide.

All of our position reports were passed to the air—air/sea rescue services all over the world. So they tracked it. Every time a position report came in it was automatically fed to them. So we were in close concert with that. We did not see any airplanes at all during the flight.

Mr. LUJAN. It's kind of interesting because one of the projects that—that we're interested in—in cooperation with the Soviets and all that is exactly those—that SARSAT.

Mr. RUTAN. The SARSAT beacon we had on board. The 406 system—it's experimental. But the nice thing about that is that it has a coded beacon, so when that beacon is interrogated they know, they can look at the code, and it's our airplane. It's not a beacon distress not knowing who it is.

Mr. LUJAN. My time is up, but I've got to ask you one more question. What's next?

Mr. RUTAN. Now, as part of the renaissance that's taking place in aviation, that we think the Voyager makes a statement for that, and if we can just speed up that transition and have people recognize that there's a much better way of doing something, and let's get on with it, if we can just do that, that's what we would like to do in the future.

Mr. LUJAN. Thank you.

The CHAIRMAN. The Chair recognizes the gentleman from California, Mr. Packard.

Mr. PACKARD. Actually, my ranking member asked the two questions that I had. But let me ask one other—and again, I want to personally congratulate you on a remarkable achievement for America and for the world.

You mentioned that you had—that you did—or were incapable of overruling or disregarding many of the rules that now exist if it were a commercial or a military venture. Is that to suggest, or would you suggest, that in the future, as we adapt some of the technology and some of the spin-offs that surely should come from Voyager, that we may have to rethink and relook at some of the existing regulations that might prevent us from doing some of the things that you were able to demonstrate?

Mr. RUTAN. That's very true, and we find that in the people that are trying to certify composite materials; that the people that are in charge of the regulation of those materials are probably not as familiar with them as they ought to be and helping the advancement of them. I call it the "aluminum inertia". There's a lot of people that have been in aluminum too long. And if you would compare—Let's just make a comparison to put it in perspective.

Let's say there was no aluminum, we didn't have 40 years of experience in aluminum, and there was two materials presented to you for selection to build airplanes with; one was composite technology as we know it now, and one was aluminum technology as we know it now—brand new. I would think that they would find that aluminum would not be successful as being selected. I used to say aluminum would have been a joke, but that's not fair. Because how it's put together, its structural, it's—how it's fatigue life, its corrosion, if nothing else, would have made it unsatisfactory. But because we have a lot of experience in aluminum, there will be some inertia, and that's what we are trying to overcome.

The Voyager is the largest, all-composite flying airplane in the world, and I think it makes a statement, that let's take another look at this and try to advance that evolution.

Another thing, as far as records go, I like to put things in a historical perspective, that makes us look at things in the future a lot better. One is that we also put in for another record, another category, and that's a speed record around the world, unrefueled, an unrefueled speed record. Well, they laughed.

But I reminded them of something. In 1909 the Wright Brothers set a speed and distance record. They went a hundred miles, and they did it at 49 miles an hour. They would have laughed even harder if somebody would have suggested in 1909 that we have a speed record category for transcontinental speed.

As long as records are here, people are going to break 'em. And I hope so. But the records we set, I hope that somebody breaks it, just as soon as possible, because they'll do so by a higher form of technology applied to a machine to do something, and that enriches our lives. And the people are free to take the courage to go and attempt something like that. And as long as we don't break records, or that people don't have the freedom to do that, that's not a world that we want to live in. And if nobody was interested in coming around to break the record that the Wrights set back in 1909, we'd still be looking up the rear ends of oxen, trying to get around, instead of on our Boeing 747s on the edge of the stratosphere next to the speed of sound with our lobster thermador and Cinerama movies. That's because somebody came out to break a record. Boy, I hope they never quit doing it.

The CHAIRMAN. The Chair recognizes the gentleman from Iowa, Mr. Nagle.

Mr. NAGLE. The observation that struck me was about your achievement, and I would just like to share a thought with you if I could.

The great focus of the conference I was at this weekend was on the capacity of our nation to be competitive, that perhaps we've lost and our industries are in a way that other countries are able to produce products cheaper and at a better rate. It's ironic that we're here this morning reviewing an accomplishment of yours, at the same time, a half-a-world away in Australia, apparently through our technology on the sea, we're about to bring back something called the American Cup.

I don't really have a question but simply a salute to you. You have reestablished what most of us have always felt, and that is, if we put our minds to it, this country is good enough not only to compete with other peoples, but to succeed and, indeed, again, as you have, set a course for others to match. And for that you have my gratitude and I think you probably have the gratitude of the nation.

Mr. RUTAN. Thank you, sir.

Ms. YEAGER. Thank you.

The CHAIRMAN. The Chair recognizes the gentleman from Louisiana, Mr. Hayes.

Mr. HAYES. I often hear the term the cutting edge of technology. I think there's someone in Washington that makes up these terms, everyone uses them, and shortly after they think of them we're sorry we ever heard of them.

I think the point that they leave out in that cutting edge is that it's not merely technical; it is just as it was 63 years ago when the gentlemen seated only two chairs behind you made that historic flight. It's a cutting edge as well in human courage, and always will be. I think it would be unfortunate if we were to skip through the technology and the ushering out perhaps of one era and into another as nothing more than a test tube advancement, or of even the brilliance of important engineers, the other element, and that is with the same intensity that you speak today that I can remember the film clips as a kid of seeing Charles Lindberg and the old clips of his landing. That intensity is almost undiminished, and I think all of us here really took the time to come over not in our duty to science or technology but in our realization that we have a chance to meet two awfully important people and to perhaps emulate that same courage by decisions we can make to do our advancing technology.

Thank you for coming. We appreciate it.

Mr. RUTAN. Thank you, sir.

Ms. YEAGER. Thank you.

The CHAIRMAN. The Chair recognizes the distinguished gentlelady from Maryland, Mrs. Morella.

Mrs. MORELLA. Again I reiterate the congratulations of my colleagues to you. You really made what was a tough year a bright one, with the morale boost that you gave us as Americans.

I was curious about what overtures have been made since that time to you from NASA and Department of Defense, and other

companies, in order to try to learn from the composite materials that you used and to kind of study what you did with the idea of trying to perhaps emulate, adapt.

Mr. RUTAN. That we feel very strongly about, what we've learned in this airplane, and we have learned quite a bit, and a lot of it was to our surprise, is that that must go into the data bank of the technology for our country.

The specifics on that I would ask Mr. Riva to comment on.

Mr. RIVA. In point of fact we initiated contact. Not knowing the right way to go about these things, I just phoned the head guy. We have made contact with General Welsh's office, Bob Lehman's office, and I believe somebody at DARPA has also contacted us, because they're working on a project down the road.

Frankly, the Voyager Project specifications meet those that were, I believe, handed out as a five-year program last year to one of the major airline builders, normally Boeing, up in Seattle, to build a plane that could do reconnaissance, stay aloft at high altitude for a long period of time, and I think they're planning or hoping to have a plane flying by 1991. We exceeded their specifications by a factor of two. But we haven't heard directly back from anybody, no.

Mrs. MORELLA. Thank you.

The CHAIRMAN. The Chair recognizes the distinguished gentleman from Florida, Mr. Nelson.

Mr. NELSON. Thank you, Mr. Chairman. I just want to congratulate you all.

When was the toughest part for you emotionally?

Ms. YEAGER. Everything from the beginning, from the time we started the program, it's been a hard, uphill climb, until we landed. That was the reward of it all.

Mr. RUTAN. I think when we realized that we had no chance of being successful in the flight, we were out of fuel. We spent about two-and-a-half days under that mode, thinking that we've—that we're not going to make it, and what are we going to do to salvage it, where are we going to land, how are we going to get the airplane home again to retry it, and think that all the stuff that we've come through up to this point, we're going to have to do it all over again. We didn't feel very good, frankly. We felt pretty down. And when we finally realized that we had the fuel to make it, we had, in fact, left Africa—out of Africa—I was very emotional and I was—frankly, I was crying when we finally went feet wet out over the Atlantic. I'd have cried harder if I'd have known what was in store for us out there, though.

Mr. NELSON. You said as you're coming up over Baja that you lost that engine. Now, you were at sufficient altitude so that, had you been able to—had you had to restart the other engine, you had sufficient altitude to, in the dark, go in and try to find a runway?

Mr. RUTAN. No. We would have been in the water. We were about 60–80 miles at sea at that time, over the ocean, and we wanted to be over the ocean because—a lot of reasons—weather, we call it cumulogranite, the mountains—you know, you don't want to run into. And there's no problem over the water about running into a mountain that I know of.

But the problem was that we had lost the tranfer pump that denied any of the fuel to the right side of the airplane, to pump

into our feed tank. And that's where the engines normally get their fuel from, the feed tank. and it's our responsibility to keep the feed tank with fuel and take it in such a manner to not upset the balance of the airplane. Now, once we lost the right pump, we were denied the fuel to the right side of the airplane and we had to go into a reversion mode where we used the engine direct to the tank. It's not really designed for it. And when the tank ran empty, it—the air cavitated the gear-driven ejector pump and it was unable to reprime. Normally we use that transfer pump to reprime the main pump, so we lost the pump and then we lost the engine. So the engine, there was nothing wrong with it, except it didn't have any fuel to it.

Even though we selected a fuel with tank—a tank with fuel, it wouldn't reprime. And it didn't reprime until we started the front engine and brought the nose to a higher angle, and then it did reprime on itself. So that's how we lost it. But the problem was that we would have had to start the front engine, we would have had to do an emergency shutdown of the back to stop it windmilling, because when it windmills, it's too much drag to even fly.

And then, because of the inefficiency of the front engine and the amount of fuel we had home, we would probably have to land in Mexico.

Mr. NELSON. At that point, you would have been able to get to——

Mr. RUTAN. On the front engine, we would have been. If we could have stopped the back engine. We were about half-way through a very complicated procedure.

I did mention we broke a lot of rules. These are not regulations, so I'm not going to get fined for them. But they are general aviation practices. All of our fuel system was not done with aluminum. It was done with real high, very lightweight plastics. And we connected them by twisted safety wire. And we went through the whole airplane and took out steel washers and replaced them with aluminum washers. There is still a place in our future for aluminum, in some areas.

But that's the type of thing that I think about, where the major aerospace companies, for a lot of reasons, would have had to put a lot more crash protection in the airplane, and they would have had to have lightning protection, and they would have had to have numerous other things that are generally accepted for commercial airplanes, and rightfully so. And if they would have been under those constraints, then they could not have flown around the world unrefueled.

Mr. NELSON. Thank you, Mr. Chairman. Thank you all.

The CHAIRMAN. The Chair recognizes the gentleman from California, Mr. Konnyu.

Mr. KONNYU. First of all I want to say that, as a Californian, we're very proud of this having occurred in California.

I would like to ask you, as I watched and listened to you, I got sort of excited about what you were doing and I wondered what was the first moment in each of your lives when you really thought that this flight will, at some time, take place and that you were going to be a part of it?

Mr. RUTAN. It's been a tough struggle for this thing, this whole thing. We're not formally financed or anything. And it was trying to find enough money to pay the rent and to talk people out of all the materials that we needed to do the project. It's been a big strain for the whole thing. And the flight itself was a big strain.

But at no time—Well, a couple of times—we tried to fly the airplane overnight initially, just to see what it would be like to spend some longer times during our flight test program, and found that we were unable to sleep at night, for a lot of reasons. That a lot of it was psychology, psychological reasons, and we landed the airplane the next morning totally fatigued and very discouraged a couple of times. And at that time, as we were recovering the airplane in the morning, very tired, we were discussing about what the "For Sale" sign was going to say on the airplane—you know, "one owner, always hangared", that type of thing. [Laughter.]

But the next morning, after a good night's sleep, you'd wake up and you'd get the feeling of how important this thing was and how fortunate we were to have an opportunity to participate in this event. And that provided the motivation, at least for me, to the whole thing. I had the feeling that we were going to do this thing no matter how long it took, or what it took. As long as we were physically able to continue, we were going to do it.

Ms. YEAGER. From the beginning, it's always been a feeling and an attitude that we're going to do this mission. It was never anyone got tired and didn't want to continue any more. So we proceeded throughout the flight with the attitude that we were going to do it.

Mr. KONNYU. And when was the first moment, if you can possibly recollect, when you really thought that you were going to do it, as opposed to "well, perhaps", that whole translation into the possibility of reality?

Mr. RUTAN. When we were within gliding distance of the dry lake at Edwards. [Laughter.]

Mr. KONNYU. Thank you.

Mr. RUTAN. I'll tell you why. I had the feeling for a race car driver, as he drives a long race and he's ahead, and the last lap is the hardest lap, because a mechanical failure then would be a lot more difficult to handle emotionally than it would a problem when you just got started. And I thought, if I had to abort this thing, please let it be at beginning and, boy, don't let it be at the end.

Mr. KONNYU. Thank you, Mr. Chairman.

The CHAIRMAN. The Chair recognizes the distinguished gentleman from Florida, Mr. Lewis.

Mr. LEWIS. Thank you, Mr. Chairman.

I'd like to offer my congratulations to you as well. Few events in aviation history have captured the attention of the American people, and the hearts of the American people, like your trip, and I think it was absolutely needed after the tragedy we had in January of—January a year ago. So I want to offer my congratulations to both of you.

Having been in airplanes and power plants all my life, I almost was flying with you several times. I couldn't wait until I got the reports. But I would like to ask you a couple of questions.

Why did you avoid any Government funding in this project?

Mr. RUTAN. It was never offered. [Laughter.]

Mr. LEWIS. Well, that's unusual. We usually stick our nose in everything.

But do you think that future projects similar to yours would have a greater chance if you had Federal funding?

Mr. RUTAN. There are some other—there are some other projects that stand a better chance of being funded, based on what we have done. We did search—For the next 18 months, after that thing was drawn on a napkin in that restaurant, we spent everything that we had physically, all of our earthly assets, to try to find a suitable sponsor, and were unable to find a suitable sponsor. We wanted it to be technically involved—not tennis shoes or alcohol or cigarettes or whatever, or any kind of foreign involvement. And we had offers in those areas. They were very lucrative. But we came to the Smithsonian and I walked down that area and I thought this is a very significant thing that would happen, and it's a very proud thing, and when it's all over, I want to be able to hang that thing up in the Smithsonian, or wherever it rests, and be proud of what we did as Americans. I thought about having an American flag on it, and I thought it would be sponsored by something I could morally support. That's why I wanted it sponsored by the people that made the composites, by the people that provided the engines or the avionics or the fuel for the airplane, instead of an unrelated thing.

So that was kind of a tough criteria for sponsorships. And if you remember, in 1981 or 1982, and '3 and '4, what our country was doing, if you cast your mind back about where our industry was at those times, then it made it even more difficult to find a sponsor. So we decided to do without a sponsor.

Mr. LEWIS. At one point off South America your plane went into a 90 degree bank. What type of testing did you do, with the tremendous flexibility of those wings, to have the confidence that if something like that happened they wouldn't fold around you?

Mr. RUTAN. We could have run a structural load test, I guess, but because of the span loading of the airplane, or the fuel distribution through the entire structure, it would be very difficult, even if you had the money and the facilities, to do a load test on the airplane.

It was done analytically through the deflection angles of plus or minus 30 feet. Our test—and we had flown it around the desert in some pretty severe turbulence that has thrown the airplane around quite a bit, and our biggest concern was controlability, not necessarily structural damage.

I inadvertently, in the dark of night, flew into one of those thunderstorms. I don't know why, but we did. We were tossed around quite a bit. I saw the airplane being rolled vertically just as it spit us out of the thunderstorm. We had never banked the airplane more than 20 degrees.

Remember, it was a one-flight-test airplane. We did not do the normal envelope expansion that you do on regular airplanes, with diflutter tests or aggravated stall conditions, or controlability. In fact, if you would—when you roll out of a bank, if you didn't apply full rudder first, and then wait just a little bit before you played aileron, the airplane would roll in the opposite direction against ai-

leron. We determined that on initial flight test and it takes a lot of will power to reverse controls to try to save the airplane.

Mr. LEWIS. That's true.

Mr. RUTAN. But I don't know how we recovered. I knew we had to, and so we gave it our best try.

Mr. LEWIS. Superior pilotability certainly had to come into that as well.

The composites that you have used on this aircraft apparently are very lightweight composites. Would you feel that down the pike, into the general aircraft, general aviation industry, that we would see more composites such as this used, or even in our own military aircraft?

Mr. RUTAN. Absolutely. There's no doubt in my mind that airplanes should be made out of composite material. It's so far superior to what we have right now. You can make them cheaper and stronger and they last a lot longer with composites.

With the composites, they are very—they're all fine filaments, and you can marry the structural loads right to the requirements. If you need a structural requirement in a certain direction, you can take all the weight of the material and—we call it layup—or arrange it into that orientation without any other lateral redundancies that you have in some other materials.

Mr. LEWIS. Thank you. My time is up. But again, let me congratulate you. I think it was also a test of both yours and Jeana's endurance because the aircraft that was going to survive. Thank you, sir.

The CHAIRMAN. The Chair recognizes the distinguished gentleman from Maryland, Mr. McMillen. He's not here.

Mr. HEFLEY. Mr. Walker, the distinguished gentleman from Pennsylvania.

Mr. WALKER. Thank you, Mr. Chairman.

I was interested in your comment a moment ago. You said that you didn't take any Government help because it wasn't offered. Was it sought?

Mr. RIVA. The only Government help that we sought out deliberately, other than the previously mentioned SARSAT rescue equipment, was the aid and assistance of the State Department in educating us as to how and when to apply for overflight clearance. We knew that the amount of time Dick and Jeana would dally over any country that they had to fly was significantly different and in a different altitude than would normally be flown by aircraft, and we wanted to make sure that the specialist at the State Department, Colonel Vernon Malahy, and Ambassador Negroponte, were able to give us that advice as to how and when to apply and which countries, frankly, we would have to bother with.

During the actual flight the State Department chose, probably because they wanted to exercise the Department that normally does this function during shuttle missions, they exercised their shuttle watch program that enabled us to call in 24 hours a day and reach informed personnel should we have to plan an abort for a particular country. We did apply for permission to overfly Vietnam and Cambodia because there was absolutely no weather there at that time. The fellow at the other end of the line, I remember his lines quite well. He said, "Swiss Embassy, three weeks, don't

bother me, good-bye." So he said you chose the only countries in the world that we couldn't even bother talking to.

But, other than that, they were very informative, more than anything else. We didn't seek any other Government assistance.

Mr. WALKER. Obviously, though, if you were—well, go ahead.

Mr. RUTAN. I may have given you a wrong impression. I may have, and let me try to clarify that.

The support that we requested we received, and that goes for the Government agencies as well as individuals, from whether we wanted their labor to provide a shift on our mission control center, or a major corporation like Mobil for their synthetic oil, or Teledyne for their special engines, or Hartzell for the props and so forth. All of those were very cooperative, to provide their goods and services to support this thing.

We had other things, like general administrative costs, for salaries and insurance and the rent for the hangar, which is $112 a day, and we provided the income for that from grassroots Americans, by the sale of trinkets and posters. We would go on lecture tours and so forth. Everybody that we asked for help that we needed, we got almost total cooperation—from the National Weather Service.

I thought it was important—Being a military, a fighter pilot, I went through all these survival schools. I thought it was important to not subject Jeana to a total overwater flight with these kind of hazards without some formal sea survival training. And I asked the Air Force for that. And the Secretary of the Air Force sent Jeana down to Homestead and she went through the deep sea survival school, at no cost to us. Everything we asked for we received.

Mr. WALKER. But obviously, back in '82, '83, one of the key problems that you had was financing this, and surely someone along the line must have thought "well, you know, we're doing something of national significance here, we are developing materials and so on, I wonder if there isn't a Government program that might be able to help us."

That never occurred to you?

Mr. RUTAN. No.

Mr. WALKER. You're great Americans.

Mr. RUTAN. We were——

Ms. YEAGER. We did look at the idea of going into Government contracts, or the grants, but it looked like it was going to be too small a sum and many years to acquire the moneys, that we didn't have the time or the money to hold us over until then.

Mr. WALKER. So it was a question of time, the amount of time that would be involved in applications and approval and so on that would delay your schedule——

Ms. YEAGER. Yes.

Mr. WALKER [continuing]. Was one factor in deciding not to move in that direction.

Mr. RUTAN. Well, in retrospect, we should have done that, because in 1982 we didn't think we had another six months to wait, and we ended up taking three more years to do it. So that took a lot of our time.

And I must admit I was very naive in that area. We build airplanes and we test them. I don't know a thing about big corporations and the acquisition of funding to do something like that.

We went out with a drawing of the airplane and a scheme, if you would, a plan, a budget, and here we are. "Boy, this is a neat adventure. Help us out and we'll have a sponsorship and away we go." We found that not to be the case.

Mr. WALKER. I saw one comment in an article—I think it was made by your brother—that you did it for two million dollars, and if you had gone to the Government it would have cost four-hundred million dollars to get the same thing done.

Mr. RUTAN. Well, I didn't try to mention figures. I've been asked a lot of times how much this thing cost, and since we did not do it for money or with money, I didn't think it was really meaningful, and I thought it was kind of an insult to the people that gave of their labor to try to quantify that into money, because how do you account for something like this? I could sit down and say a million-and-a-half dollars and somebody could come up with ten million. I thought it was arbitrary and a waste of somebody's effort.

But it would be, if it was done with a major aerospace corporation, which I say things are done by committee, that it would have been very difficult, for some of the reasons that I mentioned previously.

Mr. WALKER. I thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. I thank the gentleman.

The Chair recognizes the gentleman, Mr. Buechner from Missouri.

Mr. BUECHNER. If either of you were the head of the FAA right now, knowing what you know, would you make any proposed changes in any of their regulations that either of you are aware of as pilots?

Mr. RUTAN. The only criticism I would have is that, in materials, that we find that some time the people that are tasked with regulating and inspecting and approving are not as knowledgeable about some of the advances made in composites as they could be. And maybe that's an inertia; it may take some time to improve that. And I can understand that they're very cautious because they really have an awesome responsibility to make sure that we don't have something out that's commercially used that's dangerous. And I can understand their reluctance to move ahead very rapidly.

But that notwithstanding, we need to increase our knowledge about how to regulate those things a lot more and become more familiar with it, maybe some younger blood, if you would, in those areas.

Another thing, too, is how we control our airplanes. And I'm a little disappointed to see the lack of advancement in areas—you know, we might as well face it. We have an airline industry that provides a significant amount of transportation to our people, and they're doing it with more and more antiquated equipment. We have a system that's available right now, that's GPS, the Global Positioning System, with the satellites. That system is—you know, it can satisfy the needs of aviation in the future, and we need to get on with that very fast, because things like VOR and DME,

those are old and outmoded. We need to get involved in GPS. And the GPS system will eliminate one of our biggest hazards, the thing that scares me the most when I fly airplanes, and that is a thing call midair collision. The sooner we can take that out of the skies of America, or the world, the better off we're going to be. And GPS is the answer to that.

Mr. BUECHNER. Jeana, you are obviously the smaller of the two members. Does that do anything to dispell the theory that men are the stronger race? I mean, if you were as big as Dick, you probably wouldn't have been chosen because of the size factor.

How did you feel that your training prepared you for the ardor, for the task? Did you do anything special to prepare for it, a different regimen, perhaps, than Dick, or did you do the same kind of training in preparation? I don't mean the technical training; I mean the physical and psychological training.

Ms. YEAGER. Unfortunately we didn't have the funds to have a big organization where everybody had a specific task. Unfortunately, we all wore a dozen different hats and duties. And a lot of things did not get as planned, and physical regimentation or psychological regimentations, and we ended up doing all that we could to prepare for the flight. A lot of the psychological areas came from the test flights themselves. We started off with short flights, lightweight flights, and increased, and the time periods that we were in the aircraft as well as the periods of the flight would increase. So we were slowly developing and progressing to the world flight. We had the coastal flight.

We were told it's impossible for two people to stay in such a confined area, and as we did the flight, we found out that it was possible. We were both amazed that we didn't have a lot of the effects that we were told we could have. Physiologically, we faired very well. We did have the dehydration from the flight, but we learned for the next flight, the world flight, how to do things a little better. Just everything was a learning.

Mr. BUECHNER. Lastly, have you had any inquiries from the major airplane producers to give them some consulting as to the findings you've had in your development, or are they kind of slow as, say, the FAA?

The reason I asked that is McDonnell-Douglas has it's world headquarters in my district, and if they won't call you, I'll call them. How's that?

Mr. RIVA. That's a deal.

Mr. BUECHNER. Okay.

Ms. YEAGER. We would appreciate it.

Mr. RUTAN. We're very much interested in doing that for sure. Actually, since we've got back from the flight, I don't think we've been available to even have contact. But we're going to be back in Majave here shortly and start dealing with those things.

Mr. BUECHNER. Thank you. Thank you all very much.

The CHAIRMAN. The Chair recognizes the distinguished gentleman from Pennsylvania, Mr. Walgren.

Mr. WALGREN. Thank you, Mr. Chairman.

Well, I would only like to salute both of you. You sure have captured, as you know, the imagination of so many people. You're one of the few events that many, many people will always remember

where they were when you landed. That will—I think that people mark that is a measure of how much you've caputured their imagination.

I wanted to ask two things. First, would you just speak to this midair collision business and this GPS system, without the acronyms, because lots of people don't really know the systems—and I'm one who does not know those systems—and I'd like to get you to talk just a little bit about that. And then, secondly, I wanted to ask if you can also—I apologize for having not been able to be here earlier and you might have covered a lot of this ground, but I wanted to ask you to express your frustrations with looking to the Government for some kinds of necessary help, as you did in a couple of sentences there, and also, as you say, you thought it would be simply a matter of going out and getting sponsors and doing it and it didn't turn out to be that way.

Do you have any suggestions for how we can have some better pick up in our system for people trying to do something like yourself? Is there any suggestions you can make along that line? Because you've really done something very extraordinary and we want to encourage that in every way we can.

Mr. RUTAN. The support that we required from Government or other agencies was more than willing to provide it, and I hope I didn't give a bad impression about that. But direct funding, where they—The goods and services came more than willingly to all of us. Everything we asked for we got. However, the GNA I call it, or general administrative practices, the costs of those things, provide cash flow. Since we didn't—the only product that we were going to produce we were not going to sell, we were only going to make one of them, and we're going to give that one away, so the financial base of the corporation had some inconsistencies that were kind of difficult. So the only thing we had to sell was our publicity, and so we had to make the best of that. It was enough to make the project possible.

In looking back on it, I don't know that that was a bigger problem. In fact, I'm more proud of the fact that we did this on our own than if we'd have been the pawn of some large corporation. I just—You know, I thank God that all those people that I asked to help me said no, because I wouldn't feel anywhere near as good as I do right now if they'd have said yes. I don't know that that's a big problem.

There's another comment—oh, about the GPS. The Global Positioning System, there's a constellation I think of seven satellites up to do the research and development of that particular program. And that means we can only have fixing every four or five hours out of the day. It's an experimental state right now, and I believe there was a major avionics contract awarded by the Congress for the two competitors in that area—Motorola?

Mr. RIVA. Yeah, I think it's Motorola, and Allied——

Mr. RUTAN. I'm sorry. There were two major companies in competition and the contract was awarded one of them. But that system provides extremely accurate fixing, both vertically and horizontally, to everything that flies.

Mr. RIVA. It's a bit like having a highway in the sky for the first time. You can have eight lanes going either direction; you know where you are within 20, 30 feet.

Mr. WALGREN. Would that pick up the Cessnas in the Los Angeles air space?

Mr. RIVA. Oh, yeah. You can put it on any aircraft; you can just run the airplanes. You know exactly where they are. The guy on the ground can get a fix from the satellites that'll tell him as well.

If we use modern telemetry and modern systems, and build them up—and it's not like technology that's yet to come; this is existing technology—if we just implemented it now, we could have 12-lane highways backwards and forwards between the coasts, no problem at all, and you wouldn't have any of this nonsense of a small plane saying, "Gee, I don't know where I am."

Mr. WALGREN. Well, thank you, Mr. Chairman. I certainly want to salute you. You have captured everyone's imagination and we congratulate you on your return.

The CHAIRMAN. I thank the gentleman from Pennsylvania.

For a little rebuttal time, I'll call on the distinguished gentleman from California, Mr. Clausen, with the FAA.

Mr. CLAUSEN. First of all, I want to thank you, Mr. Chairman, for once again giving me the privilege of sitting with you on a given committee, as we did for a number of years, and also with Mr. Lujan, where I served with him on the committee.

I think there's two things that I would like to comment on, in addition to echoing the remarks that have been made about how truly proud we are of this kind of a private initiative that was taken by two people. And I think it is this: that we have equipment, we have material, but there's one thing that is most significant, most important, and that's the human factor.

I think if there's one thing that I would suggest, that we pay a lot more attention to, and that's the whole concept of human factor engineering as it relates to a part of the total product. That's something that I—and I think that's a statement that you're making in this regard.

And then finally, with regard to the Global Position Navigation System, you will be pleased, Dick and Jeana, and Peter, to know that the Administrator, Admiral Don Engen, in a speech before the Air Traffic Control Association's annual banquet, he, too, agrees with your position and is becoming an advocate of that. As a matter of fact, he has indicated that some of the current facilities and equipment that we're contracting for on an interim basis in many ways may very well be obsolete before too long. So he'll be pleased to hear your endorsement of what he has said. As a matter of fact, I'd better get you a copy of his speech so that you'll feel more comfortable. It's something that clearly needs to be done, but it's again a matter of keeping pace with the available technology. You can rest assured that I took a lot of notes on what you have said and will communicate them directly.

As a matter of fact, I'd like to have a transcript of those relevant points to the FAA, so that I can hand them to him personally.

Once again, I want to thank you, and on that eve of America, that great Christmas present, where I've known of you and I've met Jeana before, it was really a proud day as I watched you

swinging in over my own native State of California. Thank you very much.

Mr. RUTAN. Could I just make a—we have a couple of minutes. Let me show you—there's one slide here that I don't—I think the FAA thought that I made fun of it.

Mr. CLAUSEN. I wish I had loaned you my boots.

Mr. RUTAN. I'm sorry. Let me run up to this slide. That was a great honor that we—they're two very lovely people, and it was a real honor to meet 'em.

(Slide.)

There it is. I show that slide because it reminds me of the freedom we have. The story is—You see those two sets of numbers on the tail of the airplane, the big ones and the small ones? When we first flew the airplane, the only involvement we needed, we needed to fill out two papers from the FAA: the R&D certification, airworthiness certificate, and the registration. It takes about ten minutes to fill out both of them. The FAA inspector comes up and he looks at the airplane in the hangar, and he spent about 20 seconds looking at the airplane. And he came back and sat down at the table, a very grim look on his face, and I asked him if there was any problem. He says, "Yep". He says, "the numbers are too small."

Well, I had a lot of mixed emotions. I says, "How in the world can anybody confuse this airplane with the 14 Cessna 150s lined up at Van Nuys for takeoff?" And then, very reluctantly, I asked him if that was all, if there was anything else—I thought he had a long list of items. He says, "Nope, that's it. The numbers are too small." And then, with mixed emotions, I realized something—even though I thought it was unnecessary that I needed bigger numbers for this vehicle.

But the fact that this is the only type of bureaucratic influence, problem or whatever you want to call it, that I was going to be faced with. And I was really happy about that. And I left those two numbers on there to just remind me and anybody that looks at it about the freedom we have and how easy it was to do this project as far as the little interference we had from any kind of Government or bureaucracy.

I'll tell you what. That's not the case in any other nation, free or otherwise, in this world. I want you to keep it that way.

Mr. CLAUSEN. Mr. Chairman, I'd like to just make one additional comment, if you'll permit me. And that is, the reference made by General Wade to the value for young people and the value of education, I would certainly like to encourage you, Dick, and you, Jeana, to recognize that you now occupy a special position of prominence, which I know you know, and I would like to have you join Scott Crossfield and Chuck Yeager, as those people have used their positions of prominence in the past, on a continuing basis, to encourage the young people of America to get interested in aviation, because those are the inventors. I think you're in a unique position.

I've had the privilege of working with Bob Roe on a committee, and he was one of the members of the committee when we passed through our Public Works Committee back a few years ago a little provision that's referred to as "civil aviation information and distribution", and we call that aviation education.

So, in addition to that, in the State of New Jersey they have an extraordinary program that's going statewide, and I'm looking forward to working with all of you to advance that concept because I think that if we can advance aviation and space technology today, it's clearly going to be a factor in the future. We truly believe that excellence in education will determine the excellence in aviation and space technology for tomorrow.

Mr. RUTAN. We've been scheduled for some lecture series, and they have been with the colleges. And we're looking forward to that. It's always—it's my favorite forum, really. Thank you very much. We'll certainly do that.

The CHAIRMAN. Well, the Chair certainly wants to thank you, our guests, today, and all of our colleagues for the really substantive program, giving the American people a chance to see what we're doing in this area, and particularly your great achievement, both of you, all of you, and all the 40 people that worked with you to get this done.

I reflect upon a point, however, and I listened intently to your presentation. And I, too, thought what a wonderful country this is. You spoke of the freedom of having the chance to try, and that's really what you did, and you did something you tried.

But then I thought to myself, in listening to the General earlier about going back to the 1900s and looking at the slides that you showed of his airplane and your airplane, I thought to myself, as he spoke so eloquently of the past, you speak eloquently of the future. But, you know, the tools and materials that we have to work with, and one of the great achievements you have yet to make and can make in this particular situation you find yourself, is the adaptation of the ideas to tomorrow. It's not just what happened in your great work but the fact that you used new materials, you have new ideas, and it's alive and, what would you say, forceful. I think that's important.

The country stands as its greatness because we can do these things with our freedoms. But we all share the cumulative benefits of the adaptation of the materials that have been designed and that we're working with. That's why I'm so interested in what your composites were and how you adapted the new materials, and the marvel of the point of view that there was a navigation system that also made yourself—but that came from other pioneers too, so you put the pioneers together and you've given a new life for the future and we appreciate that.

Do me one favor, however. Don't stop here, you know. This is only the crossroads, you might say, because it's the future of the American people as they see what you're doing and what you say is basically possible.

I made a note to myself—one of fifty—I'm not the loquacious one around here, but I made fifty notes. There was one important one. I'm going to find out what NASA is doing and why there isn't an evaluation being made really right now on the work that you've done and the materials and so forth. That seems to me to be absolutely essential as a step forward, and we'll get into that to see that that's achieved.

So again, we want to thank you. I know you need some rest, so we thank you for being with us. You've made a splendid presentation and we're honored to have you here this morning.

The committee stands adjourned.

[Whereupon, at 12:05 p.m., the committee was adjourned.]

APPENDIX

Voyager statistics

Fuselage length (feet)	25.4
Wing span (feet)	110.8
Main wing area (sq. feet)	363
Forward wing (canard) area (sq. feet)	61
Cabin length (feet)	7.5
Cabin width (feet)	2.0
Cockpit length (feet)	5.6
Cockpit width (feet)	1.8
Structural weight (pounds)	939
Empty weight (pounds)	1,858
Crew and supplies weight (pounds)	825
Fuel weight (pounds)	7,254
Fuel amount (gallons)	1,209
Fuel consumed	?
Gross takeoff weight (pounds)	9,694
Highest altitude (18,000 feet at equator Northeast of Nairobi).	
Average altitude (feet)	9,000
Highest speed (mph)	130
Average speed (feet)	102
Lowest speed (mph)	75
Distance flown (miles)	25,012
Propulsion (2 propellers, fore and aft on fuselage).	
Flight time (9 days, 3 minutes, 44 seconds).	
Crew size	2
Development cost	$2,000,000
Development time (5 years, 22,000 man-hours).	

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